

Gummineæ have branched off between the Myxospongiæ and the Spongiæ.

2. In all the forms of this series, from *Halisarca* to *Suberites* or *Reniera*, we meet with the tendency to form flesh-spicules.

3. The flesh-spicules are quite independent of the rest of the skeleton, and occur in two types, Monoactinellan (anchors &c.) and Polyactinellan (stars &c.).

4. When another skeleton was already formed by production of fibres, when the flesh-spicules originate they remain small and unimportant, and in this case it is of no consequence whether the fibrous skeleton consists of horny substance (*Hircinia*), connective cords (Gummineæ), or siliceous cords (Desmacidonidæ).

5. When there was no fibrous skeleton when the flesh-spicules were formed they attained considerable dimensions, and on their own part formed connected frameworks. Both the Monoactinellan and the Polyactinellan forms occur in these sponges. The anchor-spicules of the Tetractinellidæ perhaps belong in part to the former, and the structures in Tetractinellidæ and Hexactinellidæ originating by reduction of the many rays to 4 or 6 to the latter group. The Plakinidæ unite all these with *Halisarca*.

From the series of fibrous sponges which culminates in the non-horny Monoactinellidæ branches are given off at many points in the same direction, all parallel to that powerful but homologous branch which contains the Hexactinellidæ and Tetractinellidæ.—*Zoologischer Anzeiger*, No. 164, April 7, 1884, vii. p. 201.

#### On *Orbulina* universa. By M. C. SCHLUMBERGER.

Several naturalists have already paid attention to the genetic relations which appear to exist between the *Orbulinæ* and the *Globigerinæ*, which are so abundantly distributed in our seas. Poursalès\* was the first to indicate the presence of a *Globigerina* in the interior of *Orbulinæ* dredged in the Gulf-stream. Dr. A. Krohn† made the same observation upon living *Orbulinæ* taken at Madeira. These two observers‡ concluded that the *Orbulina* gives origin to a *Globigerina*, which, increasing in size, finally bursts the sphere which encloses it and escapes to lead an independent existence. Carpenter§, in his classical work on the Foraminifera, opposes this opinion by a series of irrefutable arguments and retains the two genera *Orbulina* and *Globigerina* founded by D'Orbigny.

Recent researches upon the embryogeny of the Foraminifera have

\* Silliman's Journal, July 1858; reprinted in this Journal, ser. 3, vol. ii. p. 235.

† Referred to in a paper by Prof. Max Schultze, in the *Arch. f. Naturg.* 1860, p. 287; translated in this Journal, ser. 3, vol. vii. The point is discussed at pp. 311-313.

‡ Krohn simply observed the fact and communicated it to Max Schultze.

§ Introduction to the Study of Foraminifera, 1862.

led me to interpret the facts observed in a manner quite different from that which had been regarded as admissible. In examining the sands from a deep dredging (4255 metres) executed by the 'Talisman' at the Canaries, I found a great number of *Orbulina* of all sizes, and so clean that when soaked in chloroform and immersed in Canada balsam they became perfectly transparent. It is then observed that among the smallest of only  $320 \mu$  in diameter, and those of medium size, some are empty, while others have their cavity occupied entirely or in part by a succession of globular chambers arranged in a trochiform spire, like those of certain *Globigerinae*. The large *Orbulinae*, attaining nearly 1 millim. in diameter, are almost always empty.

These interior chambers are more easily distinguished after the removal of a portion of the *Orbulina*, or when entirely separated from their envelope. We then find that their exceedingly delicate plastrostracum is pierced by distant perforations; the chambers of the first two turns of the spire are smooth; the following chambers bear fine scattered spines, which, upon the last ones, are prolonged to the inner wall of the *Orbulina*, to which they attach themselves\*. These chambers communicate with each other and with the interior of the *Orbulina* by a small semilunar aperture, situated below and opposite to the turn of the spire. In the largest *Orbulinae* the spire does not include at the outside more than sixteen chambers.

Now all *Globigerinae*, as Carpeuter points out, even when young, have a comparatively thick plastrostracum, very closely placed perforations, one or several apertures widely invading the chambers, and a rugose exterior, in consequence of the great number of spines which cover its surface. Hence between the interior chambers of the *Orbulinae* and the *Globigerinae* there is only a resemblance of form.

On the other hand, we find many small *Orbulinae* in which the last or last two interior chambers form projections upon the sphere; but then these protuberances are surrounded by a plastrostracum as thick as the rest of the envelope. The interior chambers therefore do not quit the *Orbulina*; further, if they did so we ought never to meet with large empty *Orbulinae*.

From these facts we can draw only one logical conclusion, namely, that we have before us a case of dimorphism analogous to those which M. Munier-Chalmas and myself have already indicated in the Nummulites†, the Miliolidae‡, and many other genera of perforate and imperforate Foraminifera§.

The single chamber of the *Orbulina* is the homologue of the initial chamber of the other Foraminifera; when it remains empty

\* This fact was observed by Pourtalès.

† Bull. Soc. Géol. Fr. sér. 3, viii. p. 300; 'Annals,' ser. 5, vol. xi. p. 336.

‡ Comptes Rendus, 1883, pp. 862 and 1598; 'Annals,' ser. 5, vol. xii. p. 67.

§ Feuille des jeunes Naturalistes, 14<sup>e</sup> année; Congrès de Rouen, p. 520 (1883).

it is of the form A ; with the series of interior chambers it is of the form B. But it is necessary to remark that, as among the *Orbulinæ* we meet, on the one hand, with large empty individuals, and, on the other, with small individuals, some empty, some with interior chambers, we cannot assume in this case, as has been indicated for Miliolidae, an absorption of the large embryonal chamber.

The case of the *Orbulinæ* is in favour of our first hypothesis, and seems to demonstrate that the dimorphism of the Foraminifera is an initial character, the result of two original forms.—*Comptes Rendus*, April 21, 1884, p. 1002.

*On the Ascidian Genus Rhopalea.* By M. L. ROULE.

Philippi first described (Müller's Archiv, 1843), under the name of *Rhopalea neapolitana*, an Ascidian that he had collected in the Bay of Naples, and of which he has given a short anatomical description, but sufficiently accurate as to most of the details of organization that he has noticed. In his memoir he approximated this new genus *Rhopalea* to the *Clavellinæ*. Since Philippi's time, so far as I know, no other naturalist has studied this curious form of Ascidian ; Traustedt does not notice it in his work upon the simple Ascidia of the Bay of Naples (Mittheil. aus der zool. Stat. zu Neapel, 1883), and Herdman (Tunicata collected by the 'Challenger'), referring to the description given by Philippi, places it alongside of *Ecteinascidia*, in the family Clavelinidae.

The *Rhopaleæ* are very abundant on the shores of Marseilles on the bottom surrounding the *Zosteræ*, in the muddy sands collected by the currents at depths of from 25 to 60 metres ; hence I have been enabled to observe numerous individuals and to make a regular investigation of them. The body, of an average length of 8 to 10 millim., of a nearly pure white colour, is divided into two parts—one anterior, of triangular form, free, containing the branchia, and bearing the two siphons (buccal siphon with eight or nine, and cloacal siphon with six papillæ); the other posterior, of irregular form, adherent to the ground, and incrustated with débris of various kinds, containing the mass of the viscera. These two parts are joined together by a slender region of considerable length, through which the rectum, filled with substances destined to be rejected, may be distinguished ; the general aspect much resembles that of a somewhat stout and very large *Clavelina*.

The thick tunic is of a soft consistency around the anterior part of the body, firm and resistant around the posterior part. In this latter region the fundamental substance of the tunic encloses numerous vacuolar cells, while it contains none in the anterior region. The dermis (mantle), which is thin, bears small muscular bundles, most of which run in the direction of the length of the body ; around the siphons there also exist a certain number of annular muscular bundles. Philippi erroneously regarded as a peritoneum the portion of the dermis which surrounds the posterior visceral mass. The fundamental web of the branchia, the apertures of which are oval